GEOLOGIC ATLAS OF THE MOON GRIMALDI QUADRANGLE DEPARTMENT OF THE INTERIOR I-740 (LAC-74) USAF AERONAUTICAL CHART AND INFORMATION CENTER UNITED STATES GEOLOGICAL SURVEY 1 1 1 1 1 1 1 1 0° EXPLANATION NOTES ON BASE The base chart was prepared with advisory assistance from Dr. Gerard P. Kuiper and his collaborators, D.W. G. Arthur and E. A. Whitaker. CONTROL The position of features on this chart was determined Materials of sharp-appearing, high-rimmed, rayed craters Ray material through the use of selenographic control established primarily from the measurements of J. Franz and S. A Forms diffuse bright halos around both terra Craters with most of the following properties: sharp rim crests, Saunder as compiled by D. W. G. Arthur and E. A. and mare craters but more commonly occurs bright halos or surrounding ray fields, high and rough rim deposits, Whitaker in the Orthographic Atlas of the Moon, Edited pronounced thermal anomalies, steep interior profiles as elongated bright patches and streaks by Dr. Gerard P. Kuiper, 1960. superposed on mare. Some patches contain Cc, crater materials, undivided. Associated with craters < 10 km, too small to map individual units clusters of elongated craters; most show VERTICAL DATUM Ccr, rim material. Has both concentric and radial ridges lying on no intrinsic texture Vertical datum is based on an assumed spherical concave upward surfaces; steepest near rim crest. Grades outward figure of the moon and a lunar radius of 1738 kilo-Mostly rock fragments and secondary craters into rays and fields of secondary craters too small to map meters. The datum plane was subsequently adjusted to Ccw, wall material. Smooth-appearing and generally brighter than related to Copernican impact craters. Some 2.6 kilometers below the surface described by the 1738 surrounding deposits; restricted to interior slopes of craters diffuse irregular patches may be similar to kilometer radius to minimize the extent of lunar surface Reiner Gamma Formation of Hevelius of minus elevation value. Gradients of major surface quadrangle immediately to north and may Youthful impact craters with exception of Sirsalis J, whose profile undulations were established by interpolating Schrutka represent alteration zones within mare more closely resembles that of a volcanic cone. Rim material, Rechtenstamm computations of J. Franz's measurements ejecta; wall material, fresh talus and exposed pre-crater bedrock of 150 moon craters. The probable error of comparative elevation values is evaluated at 1000 meters Vertical datum, so established, is considered interim and will be refined as soon as a more accurate figure of the moon is determined. Dark-halo material Plains material, smooth, **ELEVATIONS** light Characteristics Characteristics All elevations are shown in meters. The relative heights Forms dark blanket around series Steep-sided, bulbous, very bright Characteristics of crater rims and other prominences above the maria of elongated, smooth-rimmed, NWdome materials of Hansteen a. St Smooth, almost uncratered and depths of craters were determined by the shadow trending depressions just east of face hackly; several small, linear, patches of light plains mameasuring technique as refined by the Department of crater Lohrmann. Apparent extent terial lying in floors of Astronomy, Manchester University, under the direction of blanket varies with illumination; of gentle individual highs. Appears Eratosthenian craters. Conof Professor Zdenek Kopal. Relative heights, thus mapped only where subadjacen superposed on adjacent mare tacts with higher terrain and established, have been referenced to the assumed topography is subdued; diffuse crater walls sharp vertical datum and have been integrated with the graddark material extends farther than ients of the surface undulations. The probable error of Complex volcanic constructional map boundaries the localized relative heights is 100 meters. Inherent form, younger than adjacent Eratos Volcanic flows possibly rewith measuring technique used, relative height deterthenian mare. Probably formed by lated to crater-forming impact Volcanic ash related to structurally minations in general E-W direction are more accurate viscous eruptive rocks; the small controlled, elongated vents, Youngthan in the N-S direction. linear depressions are probably er than local Imbrian units; upper volcanic vents. Similar to domes Elevations (referenced to datum).... age limit indeterminate Relative Elevations (referenced to surrounding FLAMSTEED G in Gruithuisen area (Eggleton and Smith, 1967; Eggleton, 1970, p. 90-Depth of crater (rim to floor)..... The feature names selected were adopted from the 1935 Ec Ecr Ecw Ecf Ecr International Astronomical Union nomenclature system with minor changes introduced in the Photographi Dark mare material Materials of sharp-appearing, rayless craters Lunar Atlas, Edited by Dr. Gerard P. Kuiper, 1960. Craters designated by capital letters were selected from the I.A.U. list of Named Lunar Formations. Supplemen-Albedo generally very low, <0.08 km except where Generally similar to correspondingly lettered Copernican crater units tary lettered formations have been added in accordance except that rim crests slightly less sharp, rim deposits slightly more locally covered by ray material; mare in crater Billy subdued, no surrounding bright halos or ray fields with the criterion suggested by Blagg and Muller. They is among darkest on Moon. Fewer superposed cr are designated by lower case letters. GRIMALDI Ec, crater materials, undivided ters than adjacent Imbrian mare. Locally well Ecr. rim material preserved primary structures such as rimless pits PORTRAYAL Ecw, wall material nd irregular depressions, as in Mare Aestatis. The configuration of the relief features and background Ecf, crater floor material. Undulating to hummocky; single occurrence Boundaries difficult to delineate and obtained coloration shown on this chart were interpreted from in floor of Grimaldi B mostly from Earth-based full-Moon photographs photographs taken at Lick, Mc Donald, Mt. Wilson, Ecp, peak material. Smooth-surfaced highs at or near center of floor Yerkes and Pic du Midi Observatories, and publishe Volcanic flows of basaltic composition probably photographs from the Lunar and Planetary Laborator closer to Apollo 12 than Apollo 11. Thinner regolith University of Arizona and Department of Astronomy Generally similar to corresponding Copernican units. Floor material, than on Imbrian mare. Could include some pyro-University of Manchester. Visual observations made w fall-back and slumped wall material. Peak material, rebounded prethe 24 inch Lowell refracting telescope, Flagst crater bedrock possibly covered with fall-back and slump materials Arizona, have also been used to add and clarify detail The pictorial portrayal of relief forms was developed using an assumed light source from the West with the angle of illumination maintained equal to the angle of slope of the features portrayed. Cast shadows were eliminated to enable complete interpretation of relief Mare material 8° Albedo range between 0.08 and 0.10. Similar to most materials of Oceanus Procellarum. Forms extensive featureless plains interrupted only by scattered small Copernican and Eratosthenian craters, rays and secondary crater clusters, and linear mare ridges Mostly flows of basaltic composition closer to rocks of Apollo 11 Materials of slightly subdued craters Hilly material Plains material, light Terra material, undulatory Characteristics Characteristics Moderately low relief with a gently Similar to correspondingly lettered Eratosthenian crater units, but Aggregates of closely spaced, Smooth almost featureless to moderately pitted undulatory to locally rough surface all physiographic elements slightly more subdued subdued to moderately steep plains mostly occupying topographic lows within texture; usually lies in topographic 2, crater materials, undivided. Associated with craters < 10 km domes or cones mostly without craters and terra troughs; some patches perched on depressions. Interrupts Oriental cr2, inner rim material of crater Hansteen small summit craters or furrows; highs at varying elevations. Contacts with higher structures. Intermediate albedo Irr2, radial outer rim material of crater Hansteen. Radial ridges grading circular or elliptical, mostly 2 to terrain abrupt. Albedo mostly intermediate. Embays outward into subdued secondary crater field where not embayed by 5 km in diameter and fills floors of craters older than Eratosthenian. Crater density higher than on mare; lacks intrinsic May be variant of unit Ip deposited Interpretation Icw2, wall material. On steep inner slopes and lower crater walls; andforms such as ridges, domes, irregular depreson surfaces of greater relief Volcanic constructional features subdued concentric structures of lower walls merge with floor unit sions, and rimless pits as present within mare or eroded blocks of other origin cf2, floor material. Relatively smooth but complexly fractured; rela-Interpretation Fluid emplacement seems required to explain general Same as for corresponding Eratosthenian units contact and multiple-elevation relations. Apparently Irr₂ represents distal ends of continuous ejecta blanket a pre-mare fill, possibly of different composition as suggested by higher albedo. Some patches may consist mostly of erosional debris derived from adjacent topographic highs by mass wasting ROCCA E Hevelius Formation Hansteen Ba Slightly swirly, lineated texture; partly or completely mantles lower ridges and grooves generally radial or subradial to Orientale basin locally diverted by topographic highs. Albedo intermediate. Includes patches of smooth to slightly hummocky material apparently mantling underlying topography, without pronounced lineations but laterally continuous with the lineated materials. Grades from a continuous blanket near Orientale basin to a patchy cover in Grimaldi quadrangle. Outermost boundaries indefinite and gradational with more regularly lineated non-swirly materials (unit IpI1) Ejecta from Orientale basin deposited ballistically at low trajectories or by radial flowage of materials outward from the basin at or near Chain-crater material Irregular-crater material Materials of slightly subdued Crater-cluster material Crater materials, undivided smooth-rimmed crater Characteristics Characteristics Characteristics Smooth, low, rim deposits sur-Rim and wall material Smooth material assoc Similar to upper Imbrian crater rounding shallow overlapping of three or more closeated with single, highly unit (Ic2) but rims more subdued. Materials of crater Damoiseau, which resembles Mostly includes craters <20 km individual craters or elongate y spaced, smooth-rim elongate or irregularly the smooth-rimmed crater Kopff on the Oriental troughs. Trend parallel to pre craters with bowl-shaped shaped craters difficult to assign to one of basin floor and some 30 similar craters on the near vailing structure; some chains interiors. Individual cra-Imbrian crater divisions Interpretation side (Wilhelms and McCauley, 1971) that appear mutually overlap; most common ters less fresh than Interpretation fresh but lack the rough rims and secondary Probably of internal origin within hilly and furrowed uni Orientale secondary cracraters typical of impact craters Mostly materials associated with Icsr, rim material. Smooth, without concentric (Ihf). Largest example is Da ters mapped elsewhere impact craters moiseau B structure near center external terraces, radial ridges, or secondary craters. Truncates Orientale-related structures Interpretation of map trending NE-SW and about May represent isolated 100 km long on southwest side of crater. Subdues subjacent secondary craters of Im-Interpretation topography for about one-half crater diameter brium or Orientale basins Icsw, wall material. Smooth, without concentric Probably of internal origin; Icsf, floor material. Smooth, but extensively fracfissure cones; related genetically to the hilly and furrowed unit (Ihf Topographic simplicity precludes Interpretation accurate age assignment Possible volcanic caldera; fracture pattern on INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1973—G72062 floor suggests post-crater doming and collapse; but Mapped 1966-71. Principal sources of geologic information: could be volcanically modified impact crater or the Lunar Orbiter photographs shown on index map, courtesy Lunar nar chart: Grimaldi (LAC 74), 1st edition, 1962 product of an unusual impact event -- a low density Orbiter Project Office, Langley Research Center, NASA: highcomet for example illumination photograph taken 17 January 1946, 7:51 U.T., Lick Observatory; low-illumination 120-inch reflector photographs, Lick Observatory (G.H. Herbig, 1961, unpublished); thermal data from Shorthill and Saari (1969); albedo data from Pohn, Wildey, and Sutton (1970). Materials of moderately subdued craters Hilly and furrowed material Hilly and pitted material Prepared on behalf of NASA under contract Nos. R-66 and W-13, Characteristics Characteristics Similar to correspondingly lettered upper Imbrian crater units but Aggregates of closely spaced, linear hills and ridges 3 to 15 km long Gently rolling to hilly terrain pitted by aggregates of subdued commonrims more subdued and recognizable rim deposits narrower. Partly and 2 to 6 km wide capped by coalescing shallow craters and distincy coalescing craters. Craters mostly narrow-rimmed or rimless, 2 to covered by Hevelius Formation or cut by structure radial to Orientale 10 km in diameter. Like unit Ihf, shows paucity of pre-Imbrian craters; ive sinuous furrows. These are mostly chain craters; where wider which are also superposed on the rims of Hansteen and craters are the dominant landforms. Within the map area there ground that appear to follow elevation contours, some smaller part older than the maria. They attest to a late and widespread than 2 km, mapped separately (as unit Ich). Smooth equidimensional mantles exteriors of some of those present up to rim crest GEOLOGIC SUMMARY Damoiseau, are more clearly of internal origin. The largest is a marked deficiency of these ancient craters, which is patches are perched on flat surfaces above adjacent terrain or period of crustal extension in this region, sometime after the nills common along with undulating to faintly lineated terrain. Rela-Interpretation particularly evident within the boundaries of the hilly and lie at a variety of local topographic elevations. The origin of Orientale basin formed. Short, relatively narrow, complexly SETTING Eggleton, R.E., 1970, Recognition of volcanoes and structural tively few pre-Imbrian craters within unit; those present either partly chain crater is the Damoiseau B structure about 100 km Same as for corresponding younger crater units Complex volcanic deposits, possibly predominantly pyroclastic, furrowed unit (Ihf) and to a lesser extent within the hilly and the light plains remains enigmatic, but emplacement in a fluid intersecting gash-like features occur in the floors of the two patterns in the Rümker and Montes Riphaeus quadrangles of The Grimaldi quadrangle lies at the southwest margin of long, near the center of the map area. A few irregularly or completely mantled. Queried patch north of crater Cruger less accumulated to considerable thickness over older cratered terrain. Pits the Moon: Arizona Univ., Tucson, Ph.D. thesis, 266 p. shaped but generally smooth-rimmed craters (Ici) are mapped pitted (Ihp) unit. These units and apparent correlatives in the state seems required to explain most of the occurrences large craters Damoiseau and Hansteen. Fracture patterns Oceanus Procellarum about 1,000 km east of Orientale, the distinct than materials to east probably of internal origin and related to the deposits, but some may Eggleton, R.E., and Smith, E.I., 1967, Preliminary geologic eastern part of the Moon, such as the materials of the Kant mapped. resembling these have been seen in some terrestrial diapirs. youngest of the lunar multi-ring basins. The distal ends of separately because of their distinctive form; these also may be secondary impact craters from unrecognized sources The intra-crater rilles appear to be related to crater modificamap of the Rumker quadrangle of the Moon: U.S. Geol. Survey the ejecta blanket surrounding the Orientale basin partly cover be of internal origin. Densely packed array of fissure cones and associated pyroclastic Plateau near the crater Descartes (Milton, 1968), appear not to tion processes--possibly uplift or doming of crater floors after the western third of the quadrangle. The relatively small, open-file report (1968). deposits similar to materials of Descartes area; older than Orientale be the result of basin formation but rather of pre-mare volcan-The most widespread units within the Grimaldi quadrangle Hartmann, W.K., and Kuiper, G.P., 1962, Concentric structures two-ring Grimaldi basin is in the northwest corner of the basin. Criiger area may be mantled by non-lineated Orientale ejecta ism. Differences between the landforms present in each unit-are mare materials, which occupy topographic depressions Regularly spaced concentric highs and lows associated with surrounding lunar basins: Arizona Univ. Lunar and Planetary quadrangle, and the Humorum basin lies about 750 km to the linear constructional forms in the hilly and furrowed unit and GEOLOGIC HISTORY of various size. Moderately cratered dark mare is assigned an multi-ring basins control much of the topography within the Lab. Commun., v. 1, no. 12, p. 51-66. southeast. A vestigial multi-ring basin mostly engulfed by coalescing subdued pits in the hilly and pitted unit-suggest Grimaldi quadrangle. These regional topographic trends in
The decipherable history of the Grimaldi quadrangle began in

McCauley, J.F., 1967, The nature of the lunar surface as Imbrian age (Wilhelms, 1970). Darker, less cratered mare mare appears to control the distribution of terra and mare compositional differences or at least differences in mode of fluence, in turn, the distribution of most of the mare and terra early pre-Imbrian time with the formation of a large impact terials locally exhibiting sharp irregular depressions, small emplacement-perhaps pyroclastics versus flows. These linear cones (not mapped), and fresh-appearing linear ridges plains materials. Grimaldi itself is a small two-ringed basin basin to the east near the crater Flamsteed, an event which S.K. ed., Mantles of the Earth and terrestrial planets: New craters Hansteen and Billy are on a northwest-trending topoterrae units are, collectively, quite distinct from the smooth assigned an Eratosthenian age (Wilhelms and McCauley, Lineated material Terra material, undivided (Hartmann and Kuiper, 1962, p. 59). Its innermost ring is presumably deposited ejecta over most of the quadrangle. The York Interscience, Pubs. p. 431-460. graphic high which represents part of the ring system of this dark mare and thus may be petrologically different. marked by a number of smooth-surfaced, isolated blocks Humorum basin formed in later pre-Imbrian time, also spread-971). These younger mare materials (Em) lie within the _____ 1968. Geologic results from the lunar precursor basin. Terra materials of distinctive texture, apparently Characteristics Characteristics Grimaldi basin and the craters Crüger and Billy. In addition, mapped as unit pIr like those seen around larger basins such ing ejecta over at least the southeastern quarter of the quadunrelated to multi-ring basins and probably of volcanic origin, probes: AIAA (Am. Inst. Aeronautics and Astronautics) Jour., Age relations between units Ihf and Ihp and the Hevelius For-Material having linear grooves oriented Terrain of intermediate albedo and moderately they occur in Mare Aestatis, an irregular depression in the as Nectaris and Crisium. The mare fill of the Grimaldi basin rangle. The Grimaldi basin also formed in the later pre-Imbri an occupy the central parts of the quadrangle. v. 6. no. 10. p. 1991-1996. mation are locally indeterminate; stringers of Hevelius appear radial to Orientale basin; occurs as ridges subdued, nondescript surface texture; southwest part of the map area that is not obviously related lies well within the circumference of this intermost ring. The and deposited a blanket of ejecta over the northern and Milton, D.J., 1968, Geologic map of the Theophilus quadrangle to overlie hilly and pitted material and in the area north of moderately high relief. Locally contains and smooth whaleback hills. Distal to and INDEX MAP OF THE EARTHSIDE HEMISPHERE OF THE MOON to a crater or a basin. Dark mare is also present along the next ring is vague but is marked by a scarp which encompasses western parts of the area. No visible trace remains of the of the Moon: U.S. Geol. Survey Misc. Geol. Inv. Map I-546. remnants of subdued pre-Imbrian craters. Cruger Hevelius apparently overlies a patch of hilly and gradational with Hevelius Formation; grooves western shore of Oceanus Procellarum between Damoiseau E GEOLOGIC UNITS about one-third of the basin. It is separated from the first ring depositional textures of the ejecta blankets of these three Number above quadrangle name refers to lunar base chart (LAC series): Moore, H.J., 1969, Subsurface deformation resulting from furrowed material. The distribution of the Hevelius Formation Commonly part of structural highs conmainly straight in contrast to swirly lineanumber below refers to published geologic map and Lohrmann A. A variant of Eratosthenian mare material, by a wide, irregular trough filled with light plains material. pre-Imbrian basins. Imbrium basin ejecta, a widespread unit missile impacts, in Geological Survey research 1969: U.S. The materials associated with craters constitute a physioaround Orientale is not symmetrical; the unit extends outward centric with pre-Imbrian basins tions in Hevelius in the central part of the Moon that defines the pre-Imbrianrecognized mostly by its low crater density, is present in the Geol. Survey Prof. Paper 650-B. p. B107-B112. graphic sequence in which the degree of preservation of in two enormous plumes much farther to the north and south A vague, ancient multi-ring structure appears to control the southeastern part of the quadrangle. It is somewhat brighter Interpretation Interpretation Imbrian boundary, cannot be recognized within the Grimaldi Pohn, H.A., and Offield, T.W., 1970, Lunar crater morphology certain inferred original characteristics such as rays, radial than to the east and west. It can be traced eastward toward irregular shoreline of Oceanus Procellarum within the Grimaldi han other Eratosthenian mare, but this is apparently the quadrangle, chiefly because of the distance from Imbrium. In Mostly pre-Orientale bedrock pervasively Consists in great part of now unrecognizable and relative age determination of lunar geologic units, pt. 1 the Grimaldi quadrangle only a few hundred kilometers from quadrangle. This inferred basin explains the alternating this quadrangle, terra volcanism followed the Imbrium event result of a diffuse ray covering. Classification, in Geological Survey research 1970: U.S. basin ejecta. Mostly pre-Imbrian; relatively faulted by impact; some structure tec relative age (Pohn and Offield, 1970). Many of these craters the most prominent ring of the basin. West of the basin, on the structural highs and lows in the vicinity of the craters Hansteen and obliterated earlier craters and the depositional textures smooth surface probably due to materials can be assigned relative ages on the basis of their geologic Most mare ridges are contorted and ropy in appearance and far side of the Moon, the blanket appears to extend at least Geol. Survey Prof. Paper 700-C. p. C153-C162. tonically reactivated after basin formation and Billy. Its center lies just north of the crater Flamsteed of the ejecta blankets of the pre-Imbrian multi-ring basins. Pohn, H.A., Wildey, R.L., and Sutton, G.E., 1970, Photo-Some basin ejecta (Hevelius Formation, or processes of Imbrian age; formation of relations to regional units such as the Hevelius Formation. have sharp boundaries. Others are gentle, subdued, more twice as far as it does on the eastern side. These relations some 750 km northeast of the center of the Grimaldi quadrangle. Formation of the Orientale basin then produced an ejecta The craters of this physiographic sequence are interpreted linear features without sharp boundaries. The majority of suggest that Orientale might have been the product of an electric-photographic map of the normal albedo of the Moon, possibly present unit probably extended over considerable Hansteen and Billy lie inside the outermost recognizable ring blanket which now covers most of the western third of the mostly as impact features. Some craters, however, do not ridges appear to lie over buried structures or partly buried in Pohn, H.A., and Wildey, R.L., Photoelectric-photographic oblique impact from the east, with the bulk of the ejecta and thus occupy positions analogous to that of Archimedes Grimaldi quadrangle. Filling of irregular depressions and study of the normal albedo of the Moon: U.S. Geol. Survey appear to be part of this sequence and may be of internal large craters such as the one centered about 60 km south deposited in the down-trajectory direction to the west and in pre-Imbrian and Imbrian crater floors by plains material Prof. Paper 599-E, pl.1. origin. The smooth-rimmed crater Damoiseau, which locally of Hermann. The texture of the sharp ridges suggests an plumes at nearly right angles to the velocity vector, as seen Numerous narrow, steep-walled, flat-floored rilles cut all followed. Tensional dislocation, which produced the linear Shorthill, R.W., and Saari, J.M., 1969, Infrared observations interrupts structure radial to Orientale, and to a lesser extent eruptive origin; the more gentle ridges may be shallow in in missile cratering experiments (Moore, 1969). terra units including the Hevelius Formation, but most are rilles, occurred after terra volcanism. Sometime after most of on the eclipsed Moon: Seattle, Wash., Boeing Sci. Research the crater Criger, resemble the crater Kopff on the floor of trusives. Contact Orientale (McCauley, 1968). These smooth-rimmed craters, The remaining terra units are all common terra constituents older than the mare by which they are embayed. Several rilles, this regional faulting, the smooth-rimmed crater Damoiseau, a The Hevelius Formation (McCauley, 1967), within the Grimaldi Materials of very subdued to incomplete craters Materials of subdued chain and elsewhere on the Moon, and, because of their non-distinctive however, in the northwest part of the quadrangle near Lohrmann possible caldera, formed. Two stages of mare flooding then Wilhelms, D.E., 1970, Summary of lunar stratigraphy-telescopic some 30 of which have been identified on the near side Mare ridge quadrangle, represents the extremities of the Orientale ejecta irregular craters observations: U.S. Geol. Survey Prof. Paper 599-F, p. F1properties, less can be inferred about their origins. Age rela-A and Grimaldi C, do cut both the terra and adjacent mare. The took place, filling the lower parts of the multi-ring basins. The Dashed where approximately located (Wilhelms and McCauley, 1971), might either be calderas or blanket, and forms a discontinuous and patchy cover over much Line along approximate axis of small mare ridge; Similar to correspondingly lettered lower Imbrian crater units but tions also are difficult to determine because, with the exception most prominent is Sirsalis Rille, which can be traced for over latest of these occurred in Eratosthenian time and was re-Characteristics of the western part of the quadrangle. The unit grades eastthe products of unusual low-velocity or low-density impacts larger ridges encompassed by scarps shown with very subdued. Separate wall and rim units commonly undetectable; 200 km within the quadrangle. Another rille of similar extent, stricted to Grimaldi, Crüger, Billy, several irregular depres-Wilhelms, D.E., and McCauley, J.F., 1971, Geologic map of distinct from those that produce the more numerous rough, ward away from Orientale into both lineated and non-lineated patches. The light plains material occupies irregular depres-Same as Imbrian units Ich and line and barb symbol; barb points to base of scarp but broader, shallower, and with numerous branching parallel sions such as Mare Aestatis, and the present margins of the near-side of the Moon: U.S. Geol. Survey Misc. Geol. rim crest of smaller craters quite rounded. Many craters incomplete; high-rimmed craters of the main physiographic sequence. The terrain which does not show the identifying braided deposi-Ici but much more subdued; most Buried contact segments, extends from the south flank of Grimaldi to Da- Oceanus Procellarum. Throughout the time spanned by these bright, high- but gentle- rimmed and shallow crater Sirsalis J only segments of original circular form present ______ appear partly or completely buried tional characteristics of the blanket. moiseau. Rille trends are predominantly northeast, with major events, impact cratering continued. The last stages of lying along the Sirsalis rille also might be an internal feature. Buried unit indicated in parentheses Concealed crater rim by Imbrian terra units as it resembles in form a terrestrial cinder cone. The numerous Most of the terrae within the quadrangle are markedly different related radial structure. It has a moderate population of small north-northeast a subordinate direction. Many of the shorter internal activity are recognized in the dark-halo materials Origin unknown. Incomplete form of most craters due to burial by Interpretation Crater rim crests recognized topographically but from those of the south-central and eastern parts of the (3 km) craters but does not show any other distinctive land-_____ small, structurally controlled chain craters that occur preyounger terra materials, mare volcanic rocks, or Hevelius Formation Probably volcanic mantled by younger material dominantly within the hilly and furrowed terra unit (Ihf), but Moon, where large, degraded, closely packed pre-Imbrian forms. Although most occurrences have contacts with higher rilles appear to be tensional features which are for the most the bright dome material (CEd) southeast of Hansteen. Line at base of sharp scarp; dotted where buried; bar and ball on downthrown side; narrow graben indi-Elongate to irregular steep-walled depressions cated by ball on single line GEOLOGIC MAP OF THE GRIMALDI QUADRANGLE OF THE MOON

LUNAR ORBITER PHOTOGRAPHIC COVERAGE OF GRIMALDI

QUADRANGLE

All numbers refer to Lunar Orbiter IV high-resolution frames except

horizon; limit of useful coverage shown)

III M-213, Lunar Orbiter III medium-resolution oblique (extends to

John F. McCauley

Lineament

Narrow shallow groove, mostly associated with

Orientale radial structures

Scarp

. Crest of topographic high surrounding multi-ring

basin

Approximately located; inferred beneath younger cra-

ters and mare materials

Slump structure in crater wall

Material of rugged terra

Rugged blocks most commonly 5 to 15 km in maximum dimension,

rectilinear outlines; forms highest and most prominent ring structure

around Grimaldi, and isolated massifs along the Hansteen-Billy high.

Similar to blocks in and around other major circular multi-ringed

tional contacts with adjacent low terrain

some post-impact tectonic rejuvenation

basins, Slopes steep, smooth, and bright at Orbiter IV scale, Grada-

Prebasin rock uplifted during formation of basins by impact. Possibly

For sale by U. S. Geological Survey, price \$1.00